

10/602,915**REMARKS**

Claims 4 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is respectfully submitted that the enclosed amendment obviates the alleged indefiniteness. Accordingly, it is respectfully requested that this rejection be withdrawn.

Claim 1 is independent and stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kaushik '192 ("Kaushik") in view of Ma et al. '539 ("Ma"). This rejection is respectfully traversed for the following reasons.

The Examiner admits that Kaushik does not disclose or suggest "a hafnium oxide film or a hafnium aluminate film ... which is formed *on* the zirconium oxide film" (emphasis added). The Examiner discounts this difference between Kaushik and the present invention by relying on Kaushik's disclosure that "[h]igh K material 50 can consist of hafnium oxide, zirconium oxide, aluminum oxide, [or] combinations thereof" (col. 3, lines 39-41). Based on this teaching of Kaushik, the Examiner alleges that 'an artisan forming the device would optimize the characteristics of the device by experimentally forming the hafnium oxide film on the zirconium oxide film and by forming the hafnium oxide film under the zirconium oxide film.' This assertion is respectfully traversed.

Specifically, it is respectfully submitted that there is no basis for alleging obviousness of the claimed arrangement of films based on optimizing through routine experimentation. The "routine experimentation" basis for an obviousness rejection can only be relied upon by the Examiner if the *prior art* first recognizes the modified parameter as a result-effective variable. In the instant case,

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only Applicant has recognized and considered the importance of the claimed film arrangement as a result-effective variable, so that the Examiner can not rely on the obviousness-theory of "routine experimentation" as a basis for asserting obviousness thereof. The Examiner is directed to MPEP § 2144.05(II)(B) under the heading "C only Result-Effective Variables Can Be Optimized", which sets forth the applicable standard for determining result-effective variables:

A particular parameter must first *be recognized* as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable range of said variable might be characterized as routine experimentation. (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)).

In the instant case, the cited prior art is completely silent as to the arrangement of the respective films achieving a recognized result (indeed, the Examiner does not reference any portion of the cited prior art for this purpose); so that there is no basis for alleging obviousness thereof based on routine experimentation.

Only Applicant has recognized and considered the effects of the claimed film arrangement. Indeed, one of the features of the present invention is directed to such an arrangement so that an oxidation species diffused from the high dielectric constant film side to the silicon substrate side can be absorbed by a zirconium metal film so as to form the zirconium oxide film and *reduce absorption of the oxygen species by the silicon substrate*. Accordingly, it can be made possible for the silicon substrate itself to hardly be oxidized, thereby providing the capability to suppress a reduction in the capacitance value (see, e.g., page 5, lines 10-23 of Applicants' specification). The cited prior art neither considers nor recognize the issues related to oxidation of the silicon substrate in the particular arrangement of a high-K dielectric material. Accordingly, it is respectfully submitted that the claimed film arrangement would not have been obvious in view of routine experimentation because the cited prior art does not recognize the film arrangement, *in the particular combinational structure set forth in the claims*, as achieving a recognized result.

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In this regard, one of the inventive features of the present invention is to have a gate insulating film having a multilayer structure in which a film made of an oxide of a metal (such as, for example, HfO₂, HfSiO, HfAlO and others) having a relatively lower oxygen absorption property than Zr, is deposited on the zirconium, thereby making it possible for the dual effect of suppressing oxygen deficiencies in the gate insulating film while preventing oxidation of the silicon substrate. On the other hand, none of the cited prior art recognizes nor considers such "oxygen absorption properties" as related to a gate insulating film having a multilayer structure, and dual effect which can be achieved by configuring the structure in the particular manner set forth in claim 1.

Moreover, it is respectfully submitted that Ma does not provide any motivation for using specifically SiN, but rather, simply discloses that SiN is one among many options available. Ma does not suggest that SiN would effect the alleged motivation asserted by the Examiner at the bottom of page 3 of the outstanding Office Action, any more than using the SiO₂ layer of Kaushik. Accordingly, it is respectfully submitted that the proposed combination is improper because the Examiner has not provided the requisite *objective* evidence *from the prior art* that "suggests the desirability" of the proposed combination.

The Examiner is directed to MPEP § 2143.01 under the subsection entitled "Fact that the Claimed Invention is Within the Capabilities of One of Ordinary Skill in the Art is Not Sufficient by Itself to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

A statement that modification of the prior art to meet the claimed invention would have been [obvious] because the references relied upon teach that all aspects of the claimed invention were *individually* known in the art is *not* sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. (citing *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)).

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In the instant case, even assuming *a guendo* that Kaushik and Ma "teach that all aspects of the claimed invention [are] individually known in the art", it is submitted that such a conclusion "is not sufficient to establish a *prima facie* case of obviousness" because there is no *objective* reason on the record to combine the teachings of the cited prior art. That is, there is no *detailed* reason based on prior art for specifically replacing a SiO₂ layer with a SiN layer for any disclosed purpose (again, Ma simply discloses SiN as one of plural options). The Examiner's alleged motivation is not supported by the cited prior art, let alone as being based on using SiN specifically. In this regard, only Applicants have recognized and considered the beneficial effects which can be made possible by using specifically SiN in the particular combination set forth in claim 1.

At best, the Examiner has attempted to show only that the elements of the claimed invention are *individually* known without providing a *prima facie* showing of obviousness that the *combination* of elements recited in the claims is known or suggested in the art. For all the foregoing reasons, it is submitted that the proposed combination of Kaushik and Ma is improper.

Even further, it is submitted that the cited prior art does not provide any motivation for the aforementioned claimed combination additionally being characterized in that the high dielectric constant film can contain nitrogen. As described on page 9, lines 19-25 of Applicants' specification, according to the claimed structural combination, when exemplary hafnium oxide film 106, zirconium oxide film 107 and zirconium silicate film 108 are subjected to thermal treatment, e.g., in a nitrogen atmosphere, the present invention can obtain the outstanding effect of eliminating an impurity (carbon, hydrogen or the like) from each of the films by heating and at the same time densifying each of the films. In this regard, Yang at best discloses high-k films which can include nitrogen but is completely silent as to using such high-k films in the particular arrangement set forth

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in the present invention. Indeed, Yung fails to recognize or consider eliminating impurities using a nitrogen-containing high-dielectric film.

The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard for establishing obviousness under § 103:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claim 1 because the proposed combination fails the "all the claim limitations" standard required under § 103.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 103 be withdrawn.

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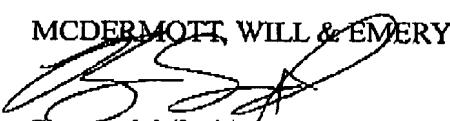
As mentioned above, the cited prior art is completely silent as to designing a gate insulating film in consideration of "oxygen absorption properties." For at least this reason and overlapping/pertinent reasons similar to those discussed above regarding claim 1, it is respectfully submitted that the cited prior art does not suggest the novel and non-obvious combination recited in new claim 37 and its dependent claims in which a relative "oxygen absorption property" between materials is defined.

CONCLUSION

Having fully and completely responded to the Office Action, Applicants submit that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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